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Approaches to Enhance Wound Healing After Periodontal Surgery: A Review of Recent Literature

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Abstract

Periodontal surgery is essential for treating advanced periodontal disease and often results in surgical wounds that require effective healing. The process of wound recovery following periodontal surgery is critical for the success of the procedure and the restoration of periodontal health. This review includes a concise outline of the healing of periodontal wounds, discussing distinct strategies to promote stable healing and improve treatment outcomes. It covers conventional wound management methods. Additionally, the review examines the roles of systemic and local antibiotics, nutritional support and various natural therapies in optimizing wound healing. Several studies and clinical trials are reviewed to assess the effectiveness of these treatments, highlighting their mechanisms, benefits, and limitations. The review emphasizes the importance of both traditional and innovative approaches to maximize healing outcomes. Ultimately, this review aims to inform better patient care and recovery after periodontal surgery, while suggesting areas for future research to enhance wound healing protocols and improve the predictability of surgical outcomes.

Keywords: Periodontal Surgery, Post-Surgical Wound Healing, Periodontists, Periodontal Dressings, Tissue Regeneration.

INTRODUCTION

Periodontal surgery:

Periodontal surgery, also known as gum surgery, is performed by a dentist, periodontist or oral surgeon. Periodontal surgery is a specialized dental procedure that focuses on treating various conditions related to the gums. The term "periodontal surgery" commonly refers to surgical manipulations of periodontal tissues and bone [1]. sometimes, to treat periodontal disease and any damage it may have caused, a periodontist may need to do periodontal surgery. Periodontal surgery is a type of dentistry that treats or prevents abnormalities in the bone, gingiva, or alveolar mucosa that are caused by trauma, anatomical faults, developmental disorders, or plaque [2].

Need of periodontal surgeries:

The following are findings that may suggest the necessities for a surgical phase of therapy: [3]

- Periodontal surgery is an oral surgery procedure used to correct or prevent defects in the bone or gums. Also, it is important for treatment of various forms of gum diseases.
- Areas with deep craters, uneven bony shapes, and other problems typically necessitate a surgical procedure.
- Surgery may be necessary for teeth with pockets where a full elimination of root irritants is not deemed clinically feasible. In the molar and premolar regions, this happens regularly.
- A surgical technique guarantees the removal of irritants in cases of grade II or III furcation involvement; surgical intervention is also required for any necessary root excision or hemisection.
- Nonsurgical techniques typically fail to resolve intra-bony pockets in the distal regions of last molars, which are sometimes compounded by mucogingival issues.

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- Surgical intervention may be necessary for severe inflammation that persists in regions with superficial to depth pockets. Persistent inflammation in regions with pockets shallow in nature or normal sulci may indicate the existence of a mucogingival issue that requires surgery.

Surgical Procedure:

There are different types of periodontal surgeries. A dentist or periodontist will determine what type of surgery or surgeries are appropriate for the specific condition of the patient [4,5].

1. Teeth extraction
2. Gingivectomy
3. Wedge procedure
4. Gingival flap procedure
5. Osseous surgery
6. Bone grafting, guided tissue regeneration
7. Clinical crown lengthening
8. Laser surgery
9. Implant surgery

Figure 1: Different Types of Dental Surgeries

Post-Surgical Complications:

Complications associated with periodontal surgery are: [6]

Hemorrhage, Postoperative pain, Infection, Swelling, Reaction to medications, Inflammatory responses to the surgical procedure can sometimes cause increased pigmentation as a secondary effect, Delayed wound healing due to Bacterial infection, Poor Blood Supply and Systemic Conditions like diabetes and Other possible complications include sensitivity in the roots, perforation of the flap, resorption of the root, ankylosis, and some reduction in the alveolar crest.

WOUND HEALING AFTER PERIODONTAL SURGERY:

A periodontal wound, apart from being caused by trauma, is typically a surgically created incision with clean, well-defined edges and significant bleeding. Such wounds generally exhibit a favorable healing prognosis. The healing process involves complex and highly coordinated mechanisms at both the cellular and subcellular levels.

Process of healing involves distinct processes: [7,8]

1. **Hemostasis:** Hemostasis occurs instantaneously to reduce blood loss. Within seconds, the defensive system is triggered as a result of the damage to the blood vessel endothelium. Immediately after injury, blood vessels shrink to reduce bleeding, and a fibrin clot forms to stabilize the wound. This clot acts as a temporary matrix for incoming cells and contains various components, including platelets and inflammatory cells.

2. **Inflammation:** Following hemostasis, blood vessels dilate, allowing cells from the immune system like both macrophages and neutrophils to migrate to the site. These cells aid in clear debris and bacteria from the wound. Inflammation is typified by redness, swelling, heat, pain and discomfort as the body responds to the injury.

3. **Proliferation:** Epithelial cells begin to migrate across the wound bed, covering the area with new tissue. This phase also involves the development of fibroblasts, which synthesize collagen and extracellular matrix. Granulation tissue forms, providing a scaffold for further healing.

4. **Maturation and Remodeling:** In the final stage of wound healing, the healed tissue goes through a remodeling then maturation phase. The newest constructed tissue undergoes remodeling, where Collagen fibers develop and realign themselves. The blood supply stabilizes, and the functional attachment of periodontal structures is established. Collagen fibers, cross-link, and increase in tensile strength. The scar tissue gradually becomes less vascularized and more similar in appearance to surrounding skin. This phase is crucial for restoring normal function and appearance to the area.

    - **Regeneration:** It is a biological mechanism that including the development of the alveolar bone, gingival ligament as well as new cementum, which completely repairs the structure along with functionality of destroyed components.

    - **Repair:** Repair is the process by which damaged tissues are healed but not fully replaced.

Periodontal Wound Healing Complications:

The healing of wounds following surgery is critical for the success of periodontal operations. After periodontal surgery, it is important to monitor wound healing. Compared to epidermal wound healing, gingival wound healing is assumed as a more thought process. Typically, healing after periodontal surgery proceeds smoothly and effectively, achieving the desired treatment goals. However, complications may sometimes arise post-surgery, which can retard the healing process. These issues may prolong inflammation, lead to necrotic or hyperplastic reactions, cause malformations or tumor-like lesions, or result in postoperative bleeding or exudation. Following regenerative surgery, proper wound healing is crucial for clinical success [9].

The healing process following periodontal surgery is typically uneventful. Problems such as bleeding, suppuration, infection, discomfort, and swelling may arise if post-operative monitoring or follow-up is carried out, particularly in patients with systemic diseases or conditions and associated habits [10].

Wound healing complications can arise from multiple factors, with infections being a primary concern due to microbial invasion disrupting tissue repair processes. Another issue involves the retention of foreign materials like debris or displaced skin cells within the wound bed, which can impair proper healing. Pigmentation process of the wound site can occur that leaving the wound with its rusted appearance. Inadequate granulation tissue development leads to irregular scar formation. Abnormal wound contraction might cause tight, restrictive scar tissue

formation, potentially leading to functional impairments. In rare cases, chronic inflammatory states from persistent healing challenges could contribute to abnormal tissue growths. Preventive strategies focus on infection control through proper wound care, optimizing blood flow, and using advanced dressings to maintain an optimal healing environment.

Factors Affecting Wound Healing: [9,11]

There are several factors affecting wound healing that delay or slow down the process of wound healing. These factors can be broadly categorized into local and systemic factors.

Local factors

There are many local factors that might affect and delay healing following gingival and periodontal surgery, a few of these factors include-

- The microbes in plaque.
- Excessive tissue manipulation during surgery can cause damage to the tissues.
- Presence of foreign entities.
- Repetitive surgical procedures may distract cellular activity during the healing.
- Unusual vascular perfusion to the adjoining area.

Systemic factors

- Age
- Nutrition
- Glucocorticoids
- People with uncontrolled diabetes.
- Anomalies of hematology.

Clinical Considerations for Successful Healing Following Periodontal Surgical therapy:[9]

- The application of initial treatment before undergoing surgery.
- The choice of a surgical strategy specific to treating the specific inflammatory ailment.
- The kind of tissue atmosphere that exists post-surgery.
- The degree of fibrosis of the gingiva before and followed surgery.
- A strategy for protecting the surgical wound during the recovery phase.
- The proper management of the dentition and the periodontium by the patient and the dentist daily and in periodic visits.
- A type of protection is needed to combat post-surgical inflammation, swelling, and bleeding and also to facilitate better recovery.

VARIOUS APPROACHES TO ENHANCE WOUND HEALING AFTER PERIODONTAL SURGERY:

Periodontal Dressing:

Definition: A periodontal dressing is a protective covering applied over areas where periodontal surgery has been performed, helping to promote tissue healing and providing protection.

Periodontal dressings are materials that protect the wound resulting from periodontal surgical procedures after the dental operation is complete. Periodontal dressing is a supportive material of a surgical intervention that is applied after periodontal therapy that covers and protects the area of the surgical wound. Periodontal dressings serve as a barrier to the wound preventing post-surgical irritation, saliva contamination and food stagnation and common injuries. They are supposed to be able to kill the pain, reduce bleeding, and accelerate the recovery process. Periodontal dressings, which are also referred as periodontal packs. The goals of periodontal dressings are to get a satisfactory healing and minimize patient's discomfort. These dressings are like a band-aid that contributes in many ways such as healing and reducing pain and stopping the site from outside factors. It not just function as a physical barrier that is placed on the site of surgery for purpose of protecting an healing tissues from this but also ensures the patient's comfort and a close adaptation. The use of periodontal dressing is highly beneficial due to the healing and stability of surgical site after periodontal surgery [12,13].

Figure 2: Periodontal dressing

History of Periodontal Dressing: [13,14]

- ✓ **1918** - **Zentler:** Introduced periodontal treatments utilizing iodoform gauze as a form of dressing.
- ✓ **1923** - **Dr. A. W. Ward:** Introduced the first commercially available periodontal dressing, named "wonder pak." This dressing was composed of zinc oxide and eugenol, combined with alcohol, pine oil, and asbestos fibers. Its primary purpose was to protect the surgical site after periodontal procedures, stabilize loose teeth, immobilize injured areas, reduce tooth sensitivity, and enhance patient comfort. Over time, advancements in periodontal dressing formulations addressed issues such as eugenol's persistent taste, rough texture, and potential for tissue necrosis, leading to the development of non-eugenol dressings in the late 1950s.
- ✓ **1942** - **Box and Ham:** Introduced the application of a zinc oxide eugenol dressing for chemical curettage in the treatment of necrotizing ulcerative gingivitis (NUG). This dressing incorporated tannic acid to promote hemostasis and provide astringent properties, while thymol was added for its antiseptic qualities.
- ✓ **1943** - **Orban:** Introduced a chemo-surgical technique for performing gingivectomy using a dressing composed of eugenol and paraformaldehyde. This method resulted in significant necrosis of both the gum tissue and underlying bone, which was believed to lead to the formation of abscesses due to the obstruction of exudate drainage.

- ✓ **1947** - **Bernier and Kaplan:** Identified the primary function of periodontal dressings as providing protection to wounds, while also noting that their components could support the healing process as a secondary benefit. By 1962, Ariaudo and tyrell expanded on this by emphasizing the use of these dressings to effectively position and stabilize flaps that are placed apically.

- ✓ **1964** - **Gold:** Suggested that a dressing could function as a splint for teeth, provided it was made from a cement material that hardened upon setting.

- ✓ **1964** - **Weinreb and Shapiro:** In a study conducted by weinreb and shapiro, it was observed that the use of zinc oxide eugenol-impregnated cords placed in periodontal pockets proved to be less effective compared to the results achieved through gingivectomy.

- ✓ **1969** - **Baer *et al.*:** Stated that main functions of a dressing are to enhance patient comfort, protect the wound from additional harm during the healing process, and secure the flap in place. They noted that dressings should not be utilized for managing postoperative bleeding or for stabilizing teeth.

Properties of Periodontal Dressings: [15,16]

The ideal characteristics of periodontal dressings can be summarized as follows:

- It should be set within a reasonable practical time.
- It should have sufficient rigidity to resist breakage and displacement.
- Once set, the surface should be smooth in order to avoid causing discomfort or irritation to the lips and cheeks.
- It should possess antibacterial properties to minimize plaque accumulation.
- The healing process should remain unaffected by their application.
- Dimensional stability is essential to prevent leakage of saliva.
- It must not cause systemic adverse effects or allergic reactions.
- The taste should be acceptable for patient comfort.
- It should be cost-effective and readily available.
- A long shelf life is desirable for extended usability.
- The smell should be pleasant and non-offensive.
- It needs to be soft, pliable, and flexible enough for easy placement and proper adaptation to the surgical site.
- Both patients and operators should find them non-irritating and non-allergic.

Purpose And Use of Periodontal Dressings: [6]

Periodontal dressings play a vital role in the recovery phase following periodontal surgery. their some primary purposes are as follows:

- **Protection:** The primary purpose of periodontal dressings is to safeguard the surgical site. They shield the wound from physical trauma, bacterial contamination, and irritants such as hot or spicy foods, thereby enhancing patient comfort and minimizing external disturbances.
- **Stabilization:** Dressings aids to stabilize teeth and tissues that are mobile. Also, prevents post-operative bleeding by maintaining the initial clot in place. It also provide additional support for free gingival grafts and assist in maintaining the surgical area's structural integrity.
- **Pain management:** By covering sensitive areas, periodontal dressings reduce discomfort and pain for patients during the healing process.
- **Healing promotion:** dressings provide a favorable environment for healing through maintaining moisture. They also aid in shaping newly formed tissues and mechanically protect the wound, which supports optimal healing conditions.

Classification of Periodontal Dressings: [16,17]

Periodontal dressings come in a variety of types, depending on composition, there are three categories of periodontal dressing include:

(i) Periodontal dressings containing zinc oxide and eugenol: They form a hard pack and exist in two forms: A) Powder and liquid form and B) Paste form.

(ii) Periodontal dressings containing zinc oxide without eugenol: Non-eugenol dressings are currently the most used periodontal dressings.

(iii) Periodontal dressings containing neither zinc oxide nor eugenol

Other various treatments have been explored to enhance healing, reduce complications, and improve patient outcomes. Below are key treatments supported by recent studies.

➢ **Antibiotic therapy:**

Systemic antibiotics can significantly reduce the risk of postoperative infections, which is crucial for optimal healing outcomes. Local delivery of metronidazole gel has a beneficial effect on healing of gingival vertical abnormalities, treted by guided tissue reconstruction [18]. Also, the topical Metronidazole-Chlorhexidine Combination gel promotes healing of intraoral incisions and reduces post-operative inflammation and lessens the pain in the first five days post-operatively. It also has the added advantage of being affordable and readily available [19].

➢ **Hyaluronic acid:**

Hyaluronic acid (HA) is frequently utilized as an adjuvant in the treatment of chronic periodontitis and post-periodontal surgery in order to enhance tissue repair and regeneration. Its local application, often combined with scaling and root planning (SRP), has been shown to reduce inflammation, bleeding on probing, and improve gingival indices. HA promotes the healing of periodontal tissues by reducing microbial load and inflammatory infiltrates, aiding in pocket depth reduction and clinical attachment level improvement. Additionally, its biocompatibility and regenerative properties support alveolar bone repair, making it a valuable tool for comprehensive periodontal therapy [20,21].

➢ **Lime peel extract:**

Adding lime (*citrus aurantifolia swingle*) peel extract to periodontal dressings has shown promising effects in enhancing gingival wound healing after injury. The extract contains flavonoids that play a crucial role in increasing the number of fibroblast cells, which are essential for tissue repair and regeneration. Studies have demonstrated that periodontal dressings supplemented with lime peel extract significantly increase the number of fibroblasts in the gingival healing process

compared to dressings without the extract. This increase in fibroblasts accelerates wound closure and promotes faster tissue repair. The optimal concentration appears to be around 10%, which resulted in the highest increase in fibroblast numbers. This enhanced healing effect provides an alternative to traditional periodontal dressings, which primarily offer wound protection without actively promoting healing [22].

- **Silver nanoparticles:**

The formulation of periodontal dressing containing silver nanoparticles (NPs) has demonstrated significant therapeutic potential in accelerating surgical wound healing and improving post-operative periodontal outcomes. Silver NPs possess potent antibacterial and anti-inflammatory properties, which help reduce microbial activity and modulate inflammatory responses at the surgical site. Studies have shown that their incorporation into periodontal dressings enhances epithelial and connective tissue repair, promotes collagen alignment, and accelerates wound re-epithelialization within a week post-surgery. These dressings protect the wound and actively facilitate tissue regeneration, making them a promising adjunct in periodontal therapy for faster recovery and improved treatment success [23].

- **Curcumin:**

When compared to betadine and chlorhexidine, curcumin at a concentration of 0.003% exhibits the best wound healing and the least amount of cytotoxicity [24]. Curcumin gel represents a useful palatal wound dressing material that has features that enhance gingival wound re-epithelization and healing and can reduce post-operative pain [25].

- **Banana peel extract gel:**

The application of gel of 10% banana peel (*Musa paradisiaca* linn. Kepok) extract has been shown significantly accelerate periodontal regeneration process in wistar rats (*rattus norvegicus*). In a study conducted by Suryono *et al.* (2023), 48 wistar rats were divided into treatment and control groups, with periodontitis induced using a modified ligation technique. Histological analysis revealed that the treatment group exhibited a marked increase in fibroblast and osteoblast counts by day five, surpassing the peaks observed in control groups by two days. This early enhancement in cellular activity indicates that the gel not only promotes healing but also supports the regeneration of periodontal tissues, making it a promising candidate for periodontal therapy [26].

- **Lemongrass extract resorbable dressing:**

Incorporating lemongrass extract (*cymbopogon citratus*) into resorbable periodontal dressings has shown positive effects on accelerating gingival wound healing after gingivectomy in rats. Studies indicate that these dressings promote faster healing by increasing fibroblast activity and collagen production, which are crucial for tissue repair. Compared to traditional treatments, the lemongrass-infused dressings effectively protect the surgical site and enhance recovery, leading to improved outcomes in periodontal treatment. This suggests that lemongrass extract could be a beneficial addition to periodontal therapies, promoting quicker and more effective healing [27].

- **Vitamin C therapy:**

The topical application of vitamin C (commercially known as enshine cream 15 g) after surgical depigmentation has been shown to enhance the rate of gingival wound healing due to its strong antioxidant properties. Vitamin C effectively neutralizes reactive oxygen species, which are generated during inflammation and can damage gingival tissues. By reducing oxidative stress, vitamin C protects tissue structure and function, promoting faster recovery. Additionally, it stimulates collagen synthesis and strengthens newly formed collagen, aiding in tissue repair. Studies have demonstrated that sites treated with vitamin c heal more rapidly, showing reduced bleeding and erythema, and achieving a healthier gingival appearance compared to untreated sites [28]. Vitamin C (ascorbic acid) has shown dual properties of effect on analgesia and healing. Its supplementations [limcee 500mg, abbott healthcare pvt. Ltd.] Twice daily for the next 2 weeks plays a significant role in post-operative wound healing and the reduction of post-operative pain after flap surgery in chronic periodontitis patients [29].

- **Gel of Potato Peel Extract:**

Potato peel (*Solanum tuberosum* L.; Solanaceae) extract gel formulations at 4% and 6% concentrations showed a faster wound healing process when compared to the povidone-iodine and triamcinolone acetonide groups. Povidone-iodine and triamcinolone acetonide groups. Potatoes (*Solanum tuberosum* L.; Solanaceae) are known for containing phenolic compounds with antioxidant, antimicrobial, and anti-inflammatory properties. These compounds may aid the Wistar rats in the healing of gingival wounds [30].

- **Orange peel rich in Polymethoxy-Flavonoids fraction as a palatal dressing material:**

The application of solid dispersion of orange peel Polymethoxy-flavonoids rich fraction (OPMF) as a palatal dressing material is a good option to accelerate healing process and reduce postoperative discomfort and pain after harvesting free gingival grafts compared with Alveogyl, in a randomized clinical trial [31].

- **Ozonized Olive Oil:**

The topical application of ozonized olive oil post-surgery was found to be a safe alternative to conventional painkillers and antibiotics, significantly accelerating wound healing in dental extraction cases. Patients using ozonized olive oil reported better healing outcomes compared to those receiving standard antibiotic treatments [32].

- **Honey dressing material:**

The use of dressing material prepared with honey on the palatal wound in after the free gingival graft harvesting operation in periodontal surgery was accelerated the palatal wound healing process. Moreover, it showed that the recovery period was shorter and morbidity after surgery was decreased [33].

- **Essential oils:**

Essential oils, particularly lavender oil, have shown promising potential in promoting wound healing and preventing infection after periodontal surgery. Studies indicate that lavender oil can enhance collagen synthesis and fibroblast activity, which are crucial for effective healing. In addition to lavender, other essential oils such as tea tree oil *(Melaleuca alternifolia)* and clove oil *(Eugenia caryophyllus)* have been recognized for their antiseptic and anti-inflammatory properties. These oils can contribute to pain relief and tissue regeneration following periodontal procedures [34,35].

- **Platelet-Rich Fibrin:**

The utilization of PRF in periodontal diseases, particularly advanced platelet-rich fibrin, gives additional advantages in the recovery of periodontal tissue. Its ease of preparation, minimal interventions, cost affordability, and satisfactory clinical outcomes have made this treatment method appealing for treating bone abnormalities and regenerating gingival recessions. Limitations that need to be taken into account include the comparatively modest volume of PRF extracted from a single blood sample and the requirement for precise handling and processing [36,37].

- **Anthocyanin complex niosome gel:**

The use of Anthocyanin complex niosome (ACN) gel which consisted of blue waxy corn and extracts of *Clitoria ternatea* petals, as well as AC niosomes (bilayered vesicles of non-ionic surfactants) on the oral lesions revealed that it not only facilitated the wound healing process but also lessened the pain due to the oral wounds assessed through In vitro scratch assay that done participants' quality of life better than AC gel, triamcinolone gel and placebo gel. This contention is in agreement with the assertion that AC delivery to fibroblasts through niosomes is improved. AC niosomes specifically promoted fibroblast activation within the injured areas and, thus, could treat the wounds on the skin much more quickly, thereby suggesting the therapeutic value of AC niosomes [38].

Table 1: Types, Name and Composition of Commercially Available Dressings

Sr. No.	Type	Name of the dressing	Composition	Manufactured by
1	Zinc oxide and eugenol dressing	Ward's wonder pack	Powder – zinc oxide, Pine resin powder, talc & asbestos Liquid – 10% isopropyl alcohol, clove oil, pine resin, pine oil, peanut oil, camphor & coloring materials	Westword dental products. Co. San. Francisco; USA
2	Zinc oxide and eugenol dressing	Kirkland formula	Zinc oxide, resin, zinc acetate, eugenol, tannic acid and olive oil.	Kirkland pack, Prudent, Corporation of America, Brookline, Maes.
3	Zinc oxide without eugenol dressing	Coe-pak	Two pastes First paste – zinc oxide, added oils, gums & lorothidol Second paste – unsaturated fatty acids & chlorothymol	Coe laboratories Inc., Chicago, IL, USA.
4	Zinc oxide without eugenol dressing	Septopack	Calcium sulphate, zinc oxide, zinc sulphate, acrylic type of resin & glycol solvent	Septodont France, Saint-Maur-des-Fossés, France.
5	Zinc oxide without eugenol dressing	Periocare	Two pastes First paste – paste of metal oxides in vegetable oil Second paste – gel of rosin suspended in fatty acids.	Pulpdent corp. Brookline watertown, MA, USA
6	Zinc oxide without eugenol dressing	Perio putty	Methylparabens, propylparabens, benzocaine	CADCO dental products, Inc., Los Angeles, CA, USA.
7	Zinc oxide without eugenol dressing	Peripac	Calcium sulphate, zinc sulphate, zinc oxide, polymethyl methacrylate, 1-dimethoxy tetraethylene glycol, flavor and iron oxide pigment.	GC America Inc., Chicago, USA
8	Neither zinc oxide nor eugenol dressing	Cyanoacrylate dressings	N-butyl cyanoacrylate	Periacryl®; glustitch Inc., delta, Canada
9	Neither zinc oxide nor eugenol dressing	Light-cure dressings	Silicon dioxide crystalline – quartz, hydrophobic amorphous fumed silica, urethane dimethacrylate resin	Barricaid®, caulk, Dentsply
10	Neither zinc oxide nor eugenol dressing	Collagen dressing	Type I collagen derived from bovine tendon mixed with cancellous granules	Colla products from zimmer dental, carlsbad, CA, USA

Table 2: Overview of Recent Studies on Wound Healing Therapies Following Periodontal Surgery

Author	Year	Study
Tansim Khaled Tawfik Abdelrahman, *et al.* [25]	2025	A study concluded that in randomized controlled trial shows that **curcumin gel** shows that it was a useful wound dressing material that has features that enable al wound re-epithelization and reduces post-operative pain.
Tiarasanti *et al*. [30]	2024	The research has affirmed that the use of 4% and 6% formulations of **Potato peel extract gel** had significantly increased the speed of a surgical wound's recovery. The study also revealed that there were no statistically significant differences between the action of the povidone-iodine and triamcinolone acetonide groups. Besides, the potato peel extract gel is the holds excellent potential for development as an alternative medicine for the natural and safe wound healing therapy. The results of experiments with human biopsies also supported the use of the gel.
Alghriany *et al.* [31]	2024	This study evaluates the therapeutic efficacy of **orange peel polymethoxy-flavonoids rich fraction (OPMF) solid dispersion as a palatal dressing material**, compared with Alveogyl, in a randomized clinical trial. The findings suggest OPMF as a palatal dressing material that facilitates hemostasis, pain relief, and palatal wound healing.
Yakout *et al.* [39]	2023	Studies was demonstrated that Application of **2% hyaluronic acid (HA) gel** showed excellent wound healing compared to photobiomodulation therapy after surgical gingivectomy
Sandhu *et al.* 28[]	2023	The topical application of **vitamin C cream** (commercially known as enshine cream 15 g) after surgical depigmentation has been shown to enhance the rate of gingival wound healing due to its strong antioxidant properties.

Suryono *et al.* [26]	2023	Study concluded that, the application of **10% banana peel extract gel** (musa paradisiaca linn. Kepok) was significantly accelerate the periodontal regeneration process in wistar rats. By Histological analysis it revealed that the treatment group exhibited a marked increase in fibroblast and osteoblast counts.
Satapathy *et al*. [32]	2023	A study highlighted the efficacy of **ozonized olive oil as a topical application** post-surgery. It was found to be a safe alternative to conventional painkillers and antibiotics, significantly accelerating wound healing in dental extraction cases. Patients using ozonized olive oil reported better healing outcomes compared to those receiving standard antibiotic treatments.
M. Alasqah *et al.* [33]	2022	According to the study, the application of **honey dressing material** after harvesting FGG, this dressing speed up the palatal wound's healing process. Additionally, there was decreased post-operative morbidity and a faster recovery period.
Fauzia *et al.* [22]	2022	The study demonstrated that **periodontal dressings supplemented with lime peel extract** significantly increase the number of fibroblasts in the gingival healing process compared to dressings without the extract. This increase in fibroblasts accelerates wound closure and promotes faster tissue repair.
T. Damrongrungruang *et al*. [38]	2021	The study concluded that, the application of **Anthocyanin complex niosome gel** that consist of extracts of purple waxy corn and blue butterfly pea petals, and AC niosomes activated fibroblasts within injured regions and accelerated wound healing.
G. Habiboallah *et al.* [23]	2014	This study concluded that, local Application of **periodontal dressing containing silver nanoparticles** (NPs) has significant therapeutic potential in accelerating surgical wound healing and improving post-operative periodontal outcomes. Silver NPs possess potent antibacterial and anti-inflammatory properties, which help reduce microbial activity and modulate inflammatory responses at the surgical site.

CONCLUSION

In conclusion, this review highlights the diverse therapeutic approaches employed to enhance wound healing post-periodontal surgery. From traditional methods to advanced techniques, each strategy offers unique benefits. There is a need to explore material or therapeutic options which is highly biocompatible, non-immunogenic, aids in the periodontal healing process, stabilize the wound tissues, reduce pain and discomfort, easy for application and economical. Optimizing wound healing through these therapies minimizes complications, accelerates tissue regeneration, and improves patient outcomes. Periodontal dressings are essential tools in the postoperative management of periodontal surgeries, offering protection, stabilization, pain relief, and promoting optimal healing conditions. Furthermore, adjunctive traditional and innovative approaches are emerging as valuable tools in enhancing healing and accelerating tissue regeneration. These treatments work synergistically with periodontal dressings to improve clinical outcomes, reduce complications, and promote faster recovery.

Incorporating these advancements into periodontal therapy not only improves patient comfort and reduces recovery time but also supports more effective wound healing. Continued research and development of novel materials and treatments will likely further optimize postoperative care and result in better long-term outcomes for periodontal patients. The integration of these innovative approaches represents a significant step forward in advancing periodontal therapy.

Future Scope

Future research should focus on ideal treatment protocols and comparative studies to establish the most effective and efficient approaches for patient needs for post-surgical periodontal wound healing, ultimately leading to enhanced periodontal health and overall quality of life.

Conflicts of Interest

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